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HORTICULTURAL CONFERENCES.

THE conjunction in August, 1930, of the Ninth International Horticultural Congress, held in London at the invitation of the Royal Horticultural Society and the Fifth International Botanical Congress, held in Cambridge the following week, both following the Third Imperial Entomological Conference commented upon in a recent issue of the Journal, brought together from all parts of the world a concourse of scientific workers interested in many facets of the wide science of horticulture. The recently formed Imperial Bureau of Fruit Production seized upon the opportunity to arrange an Imperial Horticultural Conference, which immediately preceded the International Congress and enabled the British contingent to discuss some of the problems of more particular interest to themselves in a domestic atmosphere which the larger gathering by its nature precluded. There were thus two conferences sufficiently different in scope and methods to supplement each other in value to the member of a Department of Agriculture or Research Station in the Tropics who was fortunate enough to attend both.

The Imperial Horticultural Conference was the first to be held under the aegis of the new organisation of Imperial Agricultural Bureaux, and appropriately concerned itself more with the wider questions of research organisation and policy than with detailed discussion of scientific papers. It thus afforded opportunities for contact between the new Bureau and many of those it is designed to help, and for a general interchange of views and information which should go far to ensure that the horticultural research workers of the Empire, in essentials at least, are all pulling in the same direction with the maximum of co-operation and the minimum of duplication.

The Bureau explained its work and plans for the future and invited suggestions and criticisms. Experiences of horticultural research in the Dominions, on centralized systems and unattached stations, on an industrial station and in the Tropics, were given and compared. Methods in field experimentation were discussed, and likewise the application of pure sciences to horticultural conditions. Finally a long session was devoted to fruit storage methods, and throughout the proceedings the economic aspect was kept well to the forefront.

The discussions demonstrated once more that the problems of tropical horticulture are essentially similar to those met in temperate climates, the differences being either in detail or in that the

tropical countries have more leeway to make up in investigation. As a case in point, the application of statistical methods to field experiments was discussed in three papers emanating respectively from the Bureau, the Imperial College of Tropical Agriculture and West Africa, and all agreed on the similarity both of problems to be solved and of methods to be adopted.

It was also evident that tropical horticulture is at least beginning to attract the degree of attention which is its due. Cacao was the main theme of two communications, another (from the College) dealt with banana storage and transport, and citrus, avocado and mango all appeared in the programme.

At the International Congress the main subject was " Propagation, Vegetative and Seminal," and this proved to have so many aspects that the members divided into three groups in order to grapple with it. One of the sections concerned itself especially with tropical and sub-tropical horticulture and discussed, among other subjects, the vegetative propagation of cacao, citrus and rubber, and its bearing on yield problems. The presence and contributions of American and Dutch workers on these crops were exceedingly valuable, and their experiences and results were heard with great interest. The other sections dealt more with principles of general application and ranged over the relationships of plant anatomy and of environmental conditions to vegetative reproduction, dormancy, sterility, mutations, grafting and many other aspects. Accounts of work accomplished and in progress at research centres, such as East Malling and Long Ashton, were included, and supplemented by the visits which many of the members and delegates were able to pay to the institutions themselves.

If any one general conclusion is to be drawn from the almost confusing multiplicity of topics which were passed in review at the two gatherings, it is that the day of empirical methods in horticulture is in its afternoon, and declining rapidly. From the germination of a seed or the striking of a cutting to the marketing of the crop there is scarcely a single point at which research has not already disclosed possibilities of improvements or economies, with hints of vastly more still hidden. Sir Daniel Hall, at one session, spoke in appreciative terms of the " fine gardener," whose power is the outcome of experience, observation and sympathy, usually independent of any abstract scientific knowledge. He went on to plead for more horticultural experimentation, to systematise this man's knowledge and find a basis for his practices. The aims of research could scarcely be expressed better.

Another side of the picture is presented by one of the resolutions passed by the Imperial Horticultural Conference. This emphasised the shortage throughout the Empire of adequately trained horticulturists, both for research and advisory work, and requested the Ministry of Agriculture, in conjunction with other appropriate bodies, to consider the methods whereby the desired training can be provided.

CONFERENCE NOTES.

1. The Imperial Bureau of Fruit Production.

THE Director (Mr. R. G. Hatton) said that the demand for information from the Bureau comes from investigators with very varied interests. Intensive research into problems of horticultural science is of comparatively recent date, and generally speaking the development of its technique is in its infancy.

The somewhat primitive methods used in laying out of field experiments and of interpreting the results have unfortunately widely brought them into discredit. However, most recent work points to the fact that an improvement in method is likely to bring significant results.

The Bureau has compiled an index of horticultural research within the Empire. One of its first objects must be the establishing of common points of contact, the building up of a common terminology and a more or less standardised technique. It proposes to collect and bring under review the exact knowledge so far obtained about every aspect of the fruit plant from its propagation, through all its cultural stages and even to the store-room. In so doing it hopes to enlist the assistance of all the authorities on the particular subjects concerned. It has definitely been requested to include the problems of tropical fruit crops which appear to be so closely parallel to those of deciduous fruits. Whilst making these surveys useful bibliographies will be compiled and it is proposed at stated intervals to circularise correspondents and others with lists and summaries of the chief articles in current horticultural literature.

Dealing with queries from investigators from all parts of the Empire has been, and it is hoped, will continue to be one of the Bureau's main activities. Inquiries have, so far, been of a most varied nature. A considerable number of visitors have already been received, and travel itineraries and study programmes suggested and arranged.

The Bureau is making contacts and trying to serve all those specialists interested in fruit production in its widest sense, including those physiological botanists and biochemists who are using the fruit plant as their medium of study.

2. An Industrial Research Station.

Sir Frederick Keeble gave an account of the Imperial Chemical Industries Agricultural Research Station at Jealott's Hill which had its origin in the successful and large-scale manufacture of synthetic nitrogenous fertilisers. The three partners in the work of the Station are the partners in all modern business enterprise, namely: manufacture, sales and research.

The research work is conducted under three main headings :—

(*a*) *Immediate research.* Work definitely relating to the use of fertilisers, involving direct experimentation such as fertiliser trials, pot culture, trials of fertiliser distributors, experiments

on the physical consistency of fertilisers, &c. This work has for its immediate object the testing and comparison of the agricultural value of various fertilisers and other products, as a guide to manufacturing and sales policy and to show which products are best suited to the agricultural conditions in different districts and countries at home and overseas.

(*b*) *Extension of use of fertilisers*, leading to experiments of less immediate, but of greater ultimate value, and to research on the maximum economic use of fertilisers on grassland and arable land. Among the grassland researches are included: the investigation of effect on yield and nutritive value of intensive cultivation of herbage: the means of restoring mineral deficiencies: correlation between fertilisers supplied to the soil and the vitamin contents of grass: the preservation of "intensive" grass.

Economic investigations on the practical farm scale are carried out on both arable and grass running parallel with field experiments and laboratory work.

(*c*) *Long distance pure researches*. The work under this heading is concerned with the study of plant and animal nutrition and soil fertility, the problems chosen for study being such as may point the way to new developments in the manufacture or use of fertilisers.

3. The Application of Statistical Method to Tropical and Sub-Tropical Crops.

Professor Cheesman pointed out that the great majority of tropical orchard crops are cross-fertilised and highly heterozygous. Since they are usually propagated by seed, the result is a wide range of genetic variability in plantations, and even in the few cases where budding is practised variability is probably introduced by the seedling stocks in general use.

This genetic variability is a serious handicap in the planning of field experiments. Detailed statistical survey of the range of variation existing in characters affecting yield is a primary requirement, and no less important are the isolation and propagation of standard horticultural varieties of known characters.

Among dicotyledonous crops, good prospects of improvement appear to lie in the application of clonal propagation. The scope for statistical method in the case of cacao is illustrated by the research programme of the Imperial College of Tropical Agriculture, which embraces rootstock investigations, the physiology of the existing seedling crop, and genetic survey. It is hoped that from the first of these lines of work uniform material will become available for field experiments of the type where comparison of treatments is involved.

Citrus presents somewhat similar problems of propagation, with peculiarities of its own.

Where genetic uniformity can be secured, there is no apparent further obstacle to the application of the statistical methods of modern temperate horticulture to tropical crops.

4. Fruit Products and Associated Problems.

Professor B. T. P. Barker said that while crop production is the first consideration of the horticulturist, crop disposal also requires his attention. In the case of fruit an important proportion of the crop is utilised in forms other than as fresh fruit. Following a brief review of the more important types of products, the case of cider was taken in detail to illustrate the character of the problems which have required solution or still remain to be studied with the aid of the related pure sciences.

5. Meteorology and Fruit Production.

Mr. H. V. Taylor spoke on the influence of weather on carbohydrate/nitrogen ratio, and the British scheme of research on the subject.

All experiments tend to show that for maximum cropping the correct balance is essential between carbohydrates and nitrogenous substances. Orchard management then, resolves itself into an adjustment by pruning, manuring, and cover cropping, of the inequalities produced by the natural soil and prevailing weather in each locality.

An Agricultural Meteorological Committee has been established to deal with the problem. A chain of stations has been selected throughout the country where observations are being taken on a common plan. By the study of these records our knowledge of the part played by the weather upon the fruit crop will be rendered more exact than it is at the present time.

Sir ROBERT RUTHERFORD.

It is with deep regret that we have to record the death, on 29th December, of Sir Robert Rutherford, who was Chairman of the West India Committee and of the West Indian Club and a Governor of the Imperial College of Tropical Agriculture ever since its inception. Sir Robert, at one time a senior partner of Messrs. Wilkinson & Gaviller, a firm of West Indian Merchants, was all his life closely identified with West Indian affairs. Besides his work in connection with the West India Committee he served as Deputy Chairman of the Colonial Bank, as Chairman of the British Empire Exhibition, 1924-25, and as Chairman of the City of London Trust Society.

By Sir Robert's death the College has been deprived of one of its most enthusiastic supporters. Sir Robert never missed an opportunity of keeping in close touch with all the main activities of the College, and of doing as much as he could to further its development. His familiar figure at the West India Committee where he was often to be found will be greatly missed, while his loss will be deplored by his colleagues and by the many friends whom he made in the West Indies.

G. G.

COTTON PESTS IN NIGERIA.

By F. D. Golding, M.A., F.E.S.,
Senior Entomologist, Agricultural Dept., Nigeria.

The cotton plant in Nigeria, as elsewhere, is subject to the depredations of numerous insect pests, but fortunately only a relatively small number of species are of major importance. The climate of Nigeria varies considerably from north to south and, as might be expected, these diverse conditions have a marked effect upon the insect fauna of the various cotton-growing areas. Research by many members of the Agricultural Department has proved that while American cotton can be grown successfully in the northern areas it compares unfavourably with indigenous cotton in the south for the following main reasons :—firstly, its shallow root system makes it unsuitable for intercropping, which is commonly practised in the south and, secondly, it has a markedly greater attraction for cotton stainers, *Dysdercus* spp. The comparative immunity of exotic cotton in the north to stainer attack appears to be entirely due to the earlier onset of atmospheric aridity in that area, for stainers occur there in very large numbers during the latter part of the rainy season. It seems probable that, in the west of Nigeria, the river Niger forms the approximate boundary between the areas suitable for the cultivation of exotic and indigenous cottons.

Up to date most of the entomological research on cotton pests has been carried out in the southern areas, but as far as can be ascertained, there is no marked difference between the extent of bollworm infestation in the north and south.

Before proceeding to describe the principal pests it is advisable to stress the fact that, owing to the lack of education among the native farmers, the control measures at the disposal of the economic entomologist in Nigeria are, at present, restricted to those of either a cultural or biological nature ; as yet no favourable opportunity has arisen of utilising natural enemies for the control of Nigerian cotton pests. Cultural methods which have proved to be efficacious include the utilisation of strains of cotton resistant to certain pests, the variation of the time of planting to avoid infestation at a critical period and the replacement of exotic cotton in the south by an improved indigenous strain bred by Lewin (11 ; 1927). It will be seen that these methods involve close co-operation between the plant breeder and the entomologist.

The writer is of the opinion that, in future, more attention should be paid to the investigation of the effect of improved cultivation of the soil upon the plant's resistance to insect attack, although it is realised that the extension work required to inculcate these methods to the native farmer would need much patience and the overcoming of considerable difficulties.

Cotton Stainers.

Seven species of *Dysdercus* have been recorded from Nigeria (3 ; 1928), (1 ; 1929) ; but only *superstitiosus*, Fab., *fasciatus*, Sign., and *melanoderes*, Karsch. can be considered as major pests of cotton. Of these three, *D. superstitiosus* is undoubtedly the most important on account of its ubiquity and abundance ; the remaining two species are localised in their distribution and irregular in their annual incidence upon the cotton crop.

The writer has shown (3 ; 1928) that there are two forms of *superstitiosus* to which he has given the names of ' banded ' and ' spotted ' ; the former is restricted in range and is less abundant than the latter. All subsequent references to this species are concerned with the more important ' spotted ' form.

The seasonal incidence of *superstitiosus* presents problems of great interest which have yet to be elucidated. In the north stainers are usually abundant in September, but disappear during the succeeding month when rainfall ceases ; but in the south few specimens can be found before mid-October when a sudden influx of stainers occurs. This species shows a remarkable preference for the seeds of certain Gramineae, notably Bulrush Millet (*Pennisetum* sp.) and Maize, and it is probable that, in the wet season when cotton bolls are not available, its distribution is largely influenced by local agricultural practice, for in July and August of 1927 Mr. O. B. Lean (3 ; 1928), found stainers to be numerous on these two crops in the Benue Province. Bulrush Millet is not grown in the Ibadan district and it is extremely difficult to discover stainers of this species there before the commencement of bolling in October ; Maize is grown extensively round Ibadan, but its cobs are only suitable as food for stainers for a very short period.

As stated in the introduction to this paper the north is comparatively free from stainer infestation on account of atmospheric aridity during the bolling period, and exotic cotton in the south, which used to suffer very severely, has been replaced by a less attractive indigenous species. Further references to the stainer problem may be found in a paper (4 ; 1928) by the writer.

Other Plant Bugs.

Three Pentatomids, *Halydicoris scoruba*, Dall., *Nezara viridula*, L. and *Piezodorus pallescens*, Germ. are responsible for damage to green bolls in the Ilorin and Benue Provinces (5 ; 1928), (10 ; 1929) ; but there is evidence that their incidence on cotton is variable and their distribution somewhat restricted, *H. scoruba* has been found to breed on the cotton plant and is the most important species.

Jassids.

Empoasca facialis, Jac. caused very considerable damage to indigenous cotton on poor soil at Ilorin in the 1926-27 season (9 ; 1927), and is frequently a pest of some importance in that locality and elsewhere. Fortunately it has been found that the improved cotton bred by Lewin is remarkably resistant to Jassid attack.

White Flies.

It has been demonstrated recently (6 ; 1930) that Aleurodidae can operate as vectors of a virus disease known as Leaf Curl, but again Lewin's cotton exhibits a marked degree of immunity (12 ; 1927) probably on account of the repellent action of *foliae pubescence* upon the vectors of the disease. It has been observed that several of the indigenous cottons which are susceptible to Leaf Curl bear very few hairs on their leaves.

Cotton Mosquito.

The above name has been coined by the writer for the Capsid bug *Helopeltis bergrothi*, Reut., which occurs in the Gold Coast as a pest of Cacao and is known there as the "Cacao Mosquito." *H. bergrothi* was first recognised to be a pest of indigenous cotton in Nigeria by the writer (2 ; 1925) in 1924, and subsequently its life history was investigated by Lean (8 ; 1926) who discovered Syrphid larvae attacking the nymphs at the time of ecdysis and also bred out a Braconid parasite.

Unfortunately *H. bergrothi* is one of the few pests which exhibit a preference for the improved indigenous cotton and in recent years it has been responsible for considerable damage in several parts of the southern cotton areas, in fact it is probably the most important insect pest of cotton in the south.

The adult bugs feed on the main stem with the result that the terminal shoot dies and much stunting and distortion of the affected plants result. The nymphs feed chiefly on the lower surface of the leaves causing necrosis of the tissue surrounding their punctures and, sometimes, distortion of the entire leaf. These insects are undoubtedly a cause of bud-abscission and the possibility of their operation as accidental disseminators of bacterial disease merits investigation. It is hoped to study the possibility of control by means of the propagation of the Braconid parasite at the earliest opportunity.

Bollworms.

The principal species attacking cotton in Nigeria are :—*Diparopsis castanea*, Hmpsn., *Earias insulana, Boisd., Earias biplaga*, Walk. and *Argyroploce leucotreta*, Meyr.

In cotton survey work involving estimates of damage by various pests it is impossible to determine the damage to the crop caused by each species individually, but the percentage of locks showing evidence of attack by bollworms of all species has rarely exceeded 20.

Pomeroy (13 ; 1925) discovered that the duration of the pupal period of *D. castanea* in Nigeria is very variable at the end of the cotton season, some pupae remaining dormant in the soil for 300 days or more. No alternative food plant has been found in Nigeria and it is evident that this species depends largely for its continuance upon the adults emerging from these pupae. The uprooting of cotton plants at the end of the season is the only control measure on a large scale which has been utilised against bollworms in Nigeria. In September, 1927, larvae of *A. leucotreta* were found attacking Tangerines with the result that many fruits were abscissed before the pupation of the larvae had occurred. These shed fruits were deeply buried and few of these bollworms occurred on the cotton crop that season (5 ; 1928).

Leaf Roller.

Sylepta derogata, F. is another pest which prefers the improved cotton to the ordinary indigenous species, but it is seldom of importance being rapidly controlled by natural enemies.

A list of Nigerian insect pests of cotton and their natural enemies was published in 1927 (7 ; 1927) and contains the names of many minor pests not mentioned by the writer in this brief account of the more important species.

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STOCK PARASITES.

Helminth Parasites of Stock in the British West Indies.

(The following article, reproduced from the "Journal of Helminthology," Vol. VIII, No. 2, is by Dr. T. W. M. Cameron, M.A., D.Sc., M.R.C.V.S., who visited the West Indies in 1928, with the object of investigating problems connected with certain animal parasites.)

DURING 1928 I was able, as Milner Research Fellow in the Department of Helminthology of the London School of Hygiene and Tropical Medicine, to make an extended survey of the parasites of man and the domestic animals in the British West Indies. A report on the former has already been published (1929). In examining the parasites of domestic animals, I was given every facility by the local authorities, and I am especially indebted to Captain H. V. Metivier, B.Sc., M.R.C.V.S., of Trinidad, whose assistance and knowledge of the local parasitic problems was invaluable.

The islands which were visited extended from Trinidad in the south to St. Kitts in the north and included the four Crown Colonies of Trinidad and Tobago, Barbados, the Windward and the Leeward Islands. They fall into three natural geological groups—sedimentary islands such as Trinidad, coral islands such as Barbados and part of Antigua, and volcanic islands, a group of which includes the great majority of the others. The configuration and type of soil varies extremely and practically no two are alike. In Trinidad and in parts of Barbados and of Antigua, clay plains are common and parasitism reaches a higher degree there than elsewhere. In the coral regions drainage as a rule is good and the soil is unsuitable for the development of helminths; this is true also in the case of volcanic islands, although for different reasons. Where there is a coral substratum, water percolates rapidly through the soil; where there is a volcanic soil, slopes are steep and water rapidly runs off the surface. In both classes accordingly, in spite of the abundant rainfall and the tropical climate, conditions are not too favourable for the development of the parasitic worms and consequently individual infections are generally light. There are exceptions to this, of course, but these are isolated and relatively few and do not affect the general rule. Nevertheless, while the degree of parasitism is as a rule light, the percentage of animals harbouring helminths is high. There is, however, no sensible variation in the parasitic fauna throughout the various islands, and they will accordingly be treated as a whole in this article, such minor differences as arise being noted under the various parasites.

The domestic animals are all imported and no native stock exists—in fact native animals of any description are rare. Three type of bovine animals are found—Indian buffaloes of various breeds, pure bred Zebu cattle, and crosses between Zebus and practically every known European breed of cattle. In recent years, especially in Trinidad, pure bred cattle have been introduced for breeding purposes (mainly from Canada), but these are few in number. I had no opportunity of examining any of the pure bred stock or buffaloes. Sheep are rare and are kept entirely for food purposes; goats are more common and are used to supply both milk and meat. Pigs are found in all the islands and are generally of a nondescript "razor-back" variety. Horses, mules, and donkeys are also common. Every variety of horse from blood stock downwards is encountered; but they are now gradually being displaced by mechanical transport.

No new species of helminths was found and the lists at the end of the article show the species under the various hosts. Certain points of interest in connection with the distribution of the various forms are included in the following notes.

Cattle.

The parasites of oxen are relatively few, the commonest being *Setaria labiato-papillosa*, which, however, I only saw in Trinidad, although there is little doubt that it occurs elsewhere also. Amphistomes have been seen in the abattoirs on various occasions, but I was unable to secure specimens for examination. *Cysticercus bovis* occasionally is found as also is *Monodontus phlebotomus*, *Œsophagostomum radiatum* and *Dictyocaulus viviparus*. I was unable to find any specimens of *Syngamus laryngeus* in any of the ruminants, although it has been reported from the Greater Antilles. Since a species of Syngamus (*S. kingi*) was reported by Leiper from man in St. Lucia, repeated search has been made in the Lesser Antilles by many workers for related forms in mammals, but without success.

Sheep and Goats.

The smaller ruminants are much more constantly parasitised than are the larger. Even here, however, the degree of parasitism was usually slight and as a rule only a few examples of any one species were recovered from any one animal. The most abundant helminth in the small intestine is *Trichostrongylus instabilis;* it comprised over 95 per cent. of all the species of Trichostrongyles collected. Most of the usual European species were occasionally encountered, but a surprising and notable exception was *Nematodirus*. Why this very common form should be absent is unexplainable. *Trichostrongylus instabilis*, in addition to being common in ruminants, also occurs in human beings and West African Green monkeys in St. Kitts.

The second most abundant helminth is *Muellerius capillaris* in the lung, a high percentage of sheep and goats seen in the abattoirs being infected.

Pigs.

No trematode parasites were found or have been recorded from the British West Indies; but *Cysticercus cellulosae* is sometimes seen in the southern islands. On one occasion, I recovered a portion of a Moniezia from the small intestine of a pig in Trinidad; but it was obvious from its partly decomposed state in an intestine which was still warm, that it was not parasitic.

The most important of the nematodes occurring in West Indian pigs is undoubtedly *Stephanurus dentatus*. It generally occurs in the perirenal fat, but is not infrequently found in the liver also. It causes the condemnation of a large proportion of kidneys.

No less than four species of bursate nematodes occur in the alimentary canal; *Hyostrongylus rubidus* is found in the stomach, *Necator suillus* and *Globocephalus urosubulatus* in the small intestine and *Œsophagostomum dentatum* in the large intestine. Of the two species found in the small intestine, Necator is slightly more common in the southern islands than is Globocephalus; in the northern islands the ratio is reversed. Both species, however, are encountered in small numbers in all the islands, but no heavy infections were ever seen. Œsophagostomum is, however, sometimes found in very large numbers.

There has been a considerable amount of interest taken in the relationship between *N. suillus* and *N. americanus* and the public health significance of the former. Although I am unable to add anything to the description of the parasite given by Ackert and Payne (1923), the consistently smaller size of the porcine form suggests that it is at least, a biological variety distinct from those in man. This survey shows that it is not confined to Trinidad among these islands, but extends at least as far north as St. Kitts. I have also found it in pigs from Venezuela, and it is probable that its distribution will be found to be fairly extensive in neotropical regions. At the same time it is important to remember that at least four species of bursate nematodes inhabit the alimentary tract of the pig and all produce eggs which are more or less alike. Any conclusions therefore based on egg counts and on larvae hatched from eggs of indefinitely known origin, must be regarded with suspicion. Thus the figures of Ackert and Payne which they based on the examination of droppings alone, cannot be accepted as conclusive. This is also true with regard to the results of their infection experiments with larvae hatched from the droppings of Trinidad pigs. There is no evidence that in these cases they were dealing with Pure Necator infections; in fact, it is almost certain that they were not. It is true that the larvae of *Œsophagostomum dentatum* can be easily distinguished from that of Necator—Ackert and Payne point out that they discovered undetermined nematodes in the large intestine of pigs after an experimental infection with cultures of hookworm larvae contaminated by the larvae of this nematode. But there is no information as to the morphology or bionomics of Globocephalus. It can be assumed, however, that it will resemble somewhat closely the other hookworm larvae and will be distinguishable only with some difficulty. Their figures of the distribution of *Necator suillus* and their conclusions based on the larvae will accordingly require revision.

Ascaris lumbricoides is present in human beings in the West Indies to the extent of about 60 per cent.; in fact, it is the most prevalent human helminth in many of the islands. In over two hundred pigs examined I found Ascaris in only two of them—once in Trinidad and once in St. Kitts—and in each a single specimen was recovered. The American Hookworm Commission was rather more fortunate, however, and found this parasite in as much as 10.8 per cent. of the pigs in certain districts in Trinidad. Pigs throughout these islands are given every facility to ingest human excrement and become infected, and the adverse climatological conditions discussed earlier in this article, as is shown by the high human infection in islands where the hookworm infection is very low, do not hold good in the case of Ascaris. The fact that the human Ascarids do not develop in pigs suggests very strongly that two biological varieties of the parasite occur—one human, the other porcine.

Trichocephalus is, like Ascaris, an uncommon parasite in pigs in the West Indies, although it also is a common human parasite. Possibly in this case also, biological varieties exist.

Metastrongylus elongatus and *M. brevivaginatus* are both found not uncommonly in the lungs.

Macracanthorhynchus hirudinaceus also occurs in the small intestine of the pig, and at first sight it may be mistaken for an Ascaris. On several occasions actual perforation of the intestine was observed.

Horses, Donkeys and Mules.

These animals show the usual great variety of parasites and are probably more highly infected than any of the other domestic animals. However, the opportunities for examining them were few and the list of parasites found is consequently small. There are no obvious differences in their parasitic fauna from that found in equine hosts in other warm countries; and as usual the Sclerostomes and Cylichnostomes were the commonest species found, although the insect-borne forms are also fairly common.

Pigs:

Moniezia expansa ..	..accidental.
Cysticercus cellulosae	..not very common.
Ascaris lumbricoides	..accidental.
Trichocephalus trichiurus	..rare.
Stephanurus dentatus	..very common.
Necator suillus ..	..common.

Pigs : Contd.

Globocephalus urosubulatus	common.
Œsophagostomum dentatum	common.
Hyostrongylus rubidus	common.
Metastrongylus elongatus	common.
M. brevivaginatus	common.
Macracanthorhynchus hirudinaceus	not uncommon.

Sheep and Goats :

Fasciola hepatica	not common.
Moniezia benedeni	not very common.
M. expansa	not very common.
Cysticercus tenuicollis	not uncommon.
Trichocephalus ovis	not uncommon.
Monodontus trigonocephalus	not uncommon.
Chabertia ovina	not common.
Œsophagostumum columbianum	not common.
O. venulosum	not common.
Hæmonchus contortus	not very common.
Trichostrongylus instabilis	very common.
T. vitrinus	not common.
Cooperia curticei	not common.
C. oncophora	not common.
Ostertagia circumcincta	not common.
Dictyocaulus filaria	not common.
Muellerius capillaris	fairly common.

Cattle :

Paramphistome species (*)	uncommon.
Cysticercus bovis	uncommon.
Ascaris species (*)	uncommon.
Setaria labiato-papillosa	not uncommon.
Monodontus phlebotomus	uncommon.
Œsophagostomum radiatum	not uncommon.
Dictyocaulus viviparus	not common.

Equines :

Ascaris equorum	common.
Oxyuris equi (*)	not common.
Habronema microstoma	not uncommon.
H. muscæ (*)	not uncommon.
Setaria equina (*)	not uncommon.
Strongylus vulgaris	common.
S. edentatus	common.
S. equinus	common.
Triodontophorus minor	not uncommon.
T. serratus	not uncommon.
Trichonema spp.	very common.

(*) These species were not found by the writer, but their presence was reported by the local veterinary authorities.

Conclusion.

There were no new species seen among the helminth parasites of stock in the West Indies. As usual the degree of infection is proportional to the concentration and lack of movement of the hosts. Climatic and geological conditions are not very favourable for the development of parasites and, accordingly, infections, although common, are generally light. Species having a free-living larval stage, are especially so.

Important species from the economic point of view are the cysticerci in pigs and cattle of the two human tænias—both relatively uncommon and the kidney-worm of pigs. It is impossible yet to estimate accurately the importance of *Necator suillus* in connection with human infection ; but it is doubtful if it has any real significance. A point of interest is the great preponderance among the smaller ruminants of *Trichostrongylus instabilis* and the complete absence of Nematodirus. The most important parasitic diseases of stock in the West Indies, however, are not helminthic, but protozoal, particularly those, such as Babesiosis, which are carried by arthropods.

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SUBSIDIARY PRODUCTS.

The question of growing crops subsidiary to the staple products of a country is discussed in a recent issue of the *Bulletin of the Imperial Institute*, Vol. XXVII, p. 307, with particular reference to the tropical colonies. The danger of depending solely on one crop has recently been emphasised by the occurrence of a slump in the tobacco industry in Rhodesia, Nyasaland, and elsewhere, but many factors, notably transport, need to be considered before a suitable subsidiary export crop is selected. The industry suggested is the manufacture of essential oils, of which peppermint, geranium, and lavender appear the most promising. The oil is prepared from the plants by steam distillation, the process being carried out by the grower on the spot. A full account of the different varieties, the methods of cultivation, harvesting and preparation of the oil, is given for each plant, together with the average yields to be expected and the present market conditions. Co-operation with the Royal Botanic Gardens at Kew is being arranged, plants for trial cultivation being sent to certain areas and the resulting oil being returned to the Imperial Institute for analysis and valuation. For those desiring further information a list of useful references is appended ; the Imperial Institute is prepared to advise planters with regard to the type of oils still required and to put them into touch with makers of the necessary apparatus and merchants through whom the oils may be marketed. Intending planters are, however, also recommended to consult the agricultural officers of the country concerned so that they may obtain advice based on a thorough knowledge of local conditions.—(*Nature*, Vol. CXXV, No. 3140.)

DAIRY FARMING IN NEW ZEALAND.

By R. D. ANSTEAD, M.A., C.I.E.,
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[*The following article does not deal with tropical conditions but it is thought that it will be appreciated because of the general interest which is now being shown in milk production in the Tropics, and because it gives a good illustration of the sound development of a new country.*—Ed.]

THE growth of the dairying industry in New Zealand has been very rapid in recent years. The production of butterfat increased from 21,000 tons in 1901 to 115,000 tons in 1929. Most of this is exported and handled co-operatively. The cream is collected from individual farms and turned into butter at large central factories, where it is graded and from where it is shipped. By means of this system a standard product can be produced, and a uniformity reached, which could never be obtained were each individual farmer to make his own butter. The cows are milked with electrically driven milking machines, the milk run through separators, and the cream placed in cans by the roadside at the entrance to each farm to be collected daily by lorries and taken to the central factory.

This remarkable increase in production has been attained by the maintenance of a larger number of dairy cows per acre on the one hand and an increased production per cow on the other. This has been rendered possible by a combination of scientific principles steadily and persistently applied, *viz.*: the growing of better and purer strains of fodder grass, the better management of pastures, both by the use of fertilisers and a system of rotational grazing, and by grading up high milk producing stock by the use of pedigree bulls, especially of the Jersey and Friesian breeds. Future improvement lies in a still higher butterfat average per cow. It affords a striking example of what can be done by attacking an agricultural problem simultaneously all along the line so to speak, on scientific principles, and from this point of view is worthy of the attention of all students of modern methods of agriculture.

The original settlers, who reached New Zealand less than a hundred years ago, turned their attention mainly to sheep, and these were run over very large holdings. As the country was developed attention began to be paid to dairy farming, and gradually the farms have become smaller and cultivation more intensive. Now a survey of farms in the main dairying areas* reveals the fact that the average production of butterfat per acre decreases with the number of cows carried per acre; similarly the per cow average yield decreases; whilst the area of the farms increases, showing that high carrying capacity, high herd averages and small areas combine to produce highly per acre.

* *Vide New Zealand Journal of Agriculture*, Vol. XL, pp. 241 and 300.

The fodder grass used is mainly Italian Rye grass and farmers are rapidly learning to use pure strains of this adapted to their particular locality, which were originally evolved by the plant breeders of the Agricultural Department. There is still great scope along this line and a great deal of research is being devoted to it at the Experiment Stations.

In this connection, New Zealand affords an instructive instance of principles of selection carried out by farmers to their own detriment. The climate of the North Island is much wetter and warmer than that of the South Island. The consequence is that Rye grass in the North Island forms a permanent pasture, while in the South Island it tends to die out after a few years and pastures there are periodically put under the plough. This difference in climatic conditions has led to the natural selection of two distinct strains of grass; in the north a strain which is long lived, in the south one which is short lived. Care must now be taken when obtaining seed, as seed harvested in the south will give a short lived grass quite unsuited to the purpose of farmers in the north, and losses have resulted to those who were not aware of this, or in cases where the seed has been mixed, and buyers have found themselves after a year or two with pastures from which the Rye has died out and been replaced by weeds and undesirable grasses.

The most interesting part of the development of the industry is to be seen in the scientific use which is being made of fertilisers as top dressings and of rotational grazing, a system which is being studied in England at the instigation of Imperial Chemicals Limited.

In brief, the system now being studied is to divide the farm into small fields and to fence these off from one another, then to top dress the land with phosphates followed by sulphate of ammonia, in order to induce a rapid growth of grass, and when this is some six inches long, to concentrate the dairy stock on it for a few days and graze it down closely. The stock are then moved on to the next paddock, and thus the herd are kept moving round the farm systematically. As soon as the dairy herd is moved, sheep or dry stock are put in to eat the roughage, the field is then harrowed to scatter the dung and then rested or spelled, or if necessary, manured again to produce another crop of young grass which, will be ready to graze by the time the herd comes round again. By this system of manuring and rotational grazing more butterfat can be obtained per acre than by any other method. The grass is consumed at its most nutritional stage and when it is most palatable. It is, of course, no use manuring if the grass is not used to increase production. Having got a good growth of young succulent grass it must be at once fed and turned into butterfat and it is essential to feed it at the young stage. This means that a sufficient head of stock must be kept to deal with the area manured.

This system is being further adopted at the Government and College Farms in New Zealand, and by practical farmers themselves, and the results tend to show that a marked increase in carrying capacity can be obtained. Probably one of the greatest benefits to be derived from the system is the actual improvement brought about in the pastures themselves.

In adopting this system *de novo*, the first consideration of the farmer should be to make the best use of the grass he has by rotational and intensive grazing and then, when he is obtaining the maximum return possible in this way to begin to apply fertilisers to grow more grass. The increases to be obtained from intensive grazing are in themselves of no advantage unless the extra stock involved can be carried all the year round. This is the limiting factor, and the problem does not end with keeping the grass down. In order to carry the extra stock all through the year provision must be made for winter feed. This can be done by making silage.

Under the intensive system of manuring adopted it is found that during the growing season more grass will be produced than the herd can possibly eat, in fact, the grass gets ahead of the rotational grazing programme. Thus it is possible to close some of the fields and allow the grass to grow and then cut it and convert it into silage, to be used to tide the herd over the winter. Silage is preferred to hay for two reasons: it is better winter feed since it is prepared from grass which contains its maximum nutritive value, and it can be made at any time independently of the weather.

The system thus becomes one of a careful and clever adjustment of three factors, rapid production of grass, rapid conversion of this at its most nutritious stage into butterfat, and the adjustment of the exact number of cows which can be carried per acre to do this efficiently and which can still be maintained during the winter months when grass growth is retarded.

The third line of improvement, as already indicated, is that of building up high milk yielding herds of dairy cows by breeding from pedigree bulls, and very great strides have been made in this direction, greatly aided by the New Zealand Friesian Association, and by the Agricultural Department which carries out milking tests and issues certificates. The Association keeps a register of pedigree cattle on which they are bought and sold. It is of interest to note in this connection that in the case of Friesians the skin pattern is like finger prints, it never changes, and can be used to identify any animal throughout its life. The registers contain photographs of each animal for this purpose.

The author had the pleasure of seeing several of the prize herds, and the following recorded yields will give some idea of the progress which has been made. In 1928 seven cows in New Zealand produced over 800 lb. butterfat and the record is held by a Friesian cow with the following consecutive lactations, at five years old 986.06 lb. of fat; at six years old 1,055.25 lb.; and at seven years old 904.16 lb.

As regards actual practical results obtained on farms by use of a combination of these scientific methods the following may be quoted. At Mr. Ward's Experiment Station at Manawar which the author visited, a system of manuring and rotational grazing was being carried out on 50 acres. Thirty-seven pedigree Friesian cows and ten head of dry stock were carried, and in 1928-29 10,700 lb. of butterfat were produced, an average of 214 lb. per acre. Better results than this, however, are recorded. Mr. Dunbar on a 20-acre farm at Hurleyville, with 18 Friesians obtained 270 lb. butterfat per acre; Mr. Dickie with 35 cows averaged 397 lb. fat over 272 days, while Mr. Urquhart's herd at South Invercargill averaged on an official test 440 lb. fat per cow.

Now a word as to the economics of dairy farming in New Zealand. Labour costs are high and may be put at seven pounds per cow milked. A farm milking 53 cows per 100 acres and producing 150 to 170 lb. butterfat per acre will give a gross return of £22 10s. 0d. per cow milked, or a total of £1,200. If the farm is a low-grade one, say carrying 38 cows per 100 acres and producing only 90 to 100 lb. of butterfat per acre, the gross return will fall to £743 which emphasizes the importance of intensive farming. The maintenance costs of the first farm quoted above would come to about £633, distributed as follows:—

	£	*Per cent.*
Fertilisers	.... 92.4	14.6
Rates	.... 28.1	4.4
Fencing	.... 16.0	2.5
Cultivation	.... 9.5	1.5
Power	.... 30.2	4.8
Labour	....374.5	59.2
Depreciation	.... 32.6	5.2
Sundries	.... 49.7	7.8
	633.	100.

The profit amounts to £567. As production per acre decreases so do the total returns. Maintenance costs and labour may be reduced it is true, but the profits are materially affected as shown below.

Butterfat per acre.	*Maintenance costs.*	*Labour.*	*Profit.*
lb.	£	£	£
150-170	259	375	569
90-110	187	267	279
50-70	139	205	145

There are still great possibilities of land improvement over large areas. For example a sheep run which in 1918 was carrying 1½ sheep per acre with a cover of inferior *Agrostis tenuis* has in eight years been increased in fertility so that it now produces between 90 and 100 lb. butterfat per acre. This result has been obtained by hard work at the hands of a few young settlers determined to succeed and is an excellent example of the triumph of man over the so-called natural fertility conditions. The factors concerned are, systematic top dressing, sub-division and fencing of pastures, intensive rotational grazing, the removal of surplus grass and roughage as hay or ensilage, the provision of winter feed, the renovation of old and inferior sward by the use of the plough, the sowing of suitable pure grass strains, and we may perhaps add to this list hard work. Increased production of butterfat per cow is as a rule procured when the carrying capacity of the land is improved. The first essential for a high fat producing herd is adequate and nutritive food supply at all times of the year.

The farming of an economic area is a factor of the utmost importance, involving as it does, the consideration of both capital and labour. The fact that small farms usually produce more butterfat per acre than large farms is due to the operation of one or other, or perhaps both of these limiting factors. There are many instances of large dairy holdings in New Zealand producing very highly per acre, but they are backed by adequate capital and labour. For the small men, however, lack of capital limits progress, and it does not pay to hire labour unless that labour can be most fully utilised.

The use of manures for top dressing is one of the most necessary factors in success, and there is still room for a good deal of research on this point. The New Zealand farmer who often has a practical training at a local Agricultural College before he takes up farming, is fully alive to this, and quite ready to carry out experiments under the guidance of the local Agricultural Department.

The State holds millions of acres of waste land but a great deal of it is unsuitable for immediate settlement and needs road making and draining and considerable development before it could possibly pay any settler. To aid in this development of selected areas the Government are floating a loan. The areas developed will be sub-divided and offered for selection as soon as the land has been brought to such a state, with the help of the Agricultural Department, that settlers can expect an immediate return from farming operations on it. It is further proposed to provide special assistance to energetic and capable men, who might be willing to take up sections of waste land and do the preliminary work themselves. In addition to this the Government are proceeding with the sub-division of existing large estates suitable for closer settlement. Some of the original settlers obtained and still hold very large blocks of land on which sheep are reared, and it is these large blocks of country, often consisting of thousands of acres, which are aimed at in this policy. Such estates will be acquired by voluntary purchase where the land can be obtained at a reasonable price. To aid this policy both as regards the money needed and to force the sub-division of large holdings, a land tax has been imposed consisting of a graduated supertax on land of an unimproved value exceeding £12,500.

Acknowledgment.

(The author is indebted to the Officers of the New Zealand Agricultural Department for much of the information contained in this article. They very kindly gave him every facility for seeing what was being done, both on the Government Experiment Stations and on actual farms.)

JELUTONG.

THE production of jelutong in Malaya and Borneo continues to increase, the bulk of the output being taken by the U.S.A., where it is used as a substitute for chicle in the manufacture of chewing-gum. Chicle, the coagulated latex of the Sapodilla (*Achras sapota* L.), derived principally from Central America, commands a higher price than jelutong. The high relative cost of collection of chicle, combined with the fact that supplies are rapidly diminishing as a result of destructive tapping methods, renders it probable that the demand for jelutong will continue to increase. Borneo jelutong is derived from *Dyera Lowii* Hk. f., a tree confined to the swamps. In Malaya the product is derived from *Dyera costulata* Hk. f. and *Dyera laxiflora* Hk. f., two species occurring chiefly on flat land and low hills at altitudes below 1,500 feet. There does not appear to be any intrinsic difference in the jelutong of these three species, though the Malayan product, owing to better methods of preparation, is generally preferred and commands an enhanced price. It has been found from experimental work in Malaya that the exercise of certain precautions in coagulation and in the agents used as coagulants results in a markedly superior product. Iron, from the use of rusty tins, is now known to cause oxidation and subsequent deterioration of the finished product. Consequently attempts are being made to induce collectors to refrain from using as coagulating vessels, iron receptacles or wooden boxes caulked with clay, which also contaminate the product.

It is estimated that in America, where the consumption of chewing-gum is steadily increasing, the markets are capable of absorbing about 5,000 tons of jelutong annually. The use of chewing-gum is stated to be on the increase in parts of Europe and also in the north of England among factory hands.—(*Bull. of Mis. Inf.*, No. 10, 1930.)

COTTON NOTES.

By E. PHILLIS,
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Transport of Nitrogenous Substances in the Cotton Plant.*

It is generally recognised that the higher plants, with the exception of the leguminosae are dependent on nitrogen in some combined form—principally nitrate—in the soil, for their nutrition. The fate of the absorbed nitrate is clear—it is changed to organic nitrogen compounds such as protein, amides and amino acids. The seat of this change is not, as yet, definitely known—it is probable that there is more than one region of the plant where it may take place. It is generally assumed that the leaf is the main seat of synthesis of organic nitrogen. This might be expected from the fact that carbohydrates, which are necessary for the synthesis, are themselves formed in the leaf.

The hypothesis that the leaf is the seat of synthesis of organic nitrogen requires that there should be a movement of inorganic nitrogen from the roots to the leaves and that there should be an export of organic nitrogen from the leaves to the consuming centres. The only reason why the leaf should divert the nitrate nitrogen supply to itself is that it has a much greater pull on the transpiration stream than any other region of the plant, and it is consequently reasonable to suppose that nitrates are transported to the leaves with the transpiration stream. Curtis has attempted to prove that nitrates do not move in the wood by ringing experiments, in some of which rings of bark were removed and in others in which sections of wood were removed, leaving the bark intact. The ringing experiments were not conclusive and the possible upward movement of nitrate in the phloem of the broken-wood plants can be considered as an abnormal behaviour which may be explained on the gradient theory of Maskell and Mason.

The question of the export of organic N from the leaves has occupied several investigators. Chibnall, working with *Phaseolus multifloris* and Möthes, working with *Vicia faba* and *P. multifloris*, both found that the total N content of the leaf expressed in terms of the fresh weight showed a decrease during the night. Chibnall showed that this decrease was due to decomposition of protein, followed by the export of the organic crystalloid N produced. It will be realised that the validity of these results depends on the correctness of the basis of expression—the results of the above mentioned investigators have been criticised on the ground that fresh weight is a variable basis. Mason and Maskell introduced residual dry weight (Dry Wt. – carbohydrates) as a basis for comparison in preference to either the fresh weight or dry weight, since by its use two of the three principal variable factors—carbohydrate and water—are eliminated.

Maskell and Mason, at the Cotton Research Station in Trinidad, have recently confirmed the statement of the earlier workers on the question of a diurnal variation in nitrogen content of the leaf. Their results show that the nitrogen content of the leaf diminishes at night, whether expressed on either the dry or residual dry weight basis, the decrease being due to an export of organic nitrogen. There can be little doubt from their results that there is an import of inorganic nitrogen to and an export of organic nitrogen from the leaf. They then proceeded to identify the gross channels of transport by means of ringing experiments. Rings of bark were removed, as in the carbohydrate experiments described in Memoir No. 1. The removal of a ring of bark did not stop the movement of nitrate nitrogen into the leaf and did stop the movement of organic nitrogen along the bark, since organic nitrogen accumulated above the ring and decreased below it. Since ringing did not stop the nitrate supply to the leaf, the channel of transport of nitrate nitrogen must be the wood.

The removal of a ring of bark caused an accumulation of organic nitrogen in both wood and bark above the ring and a decrease in these tissues below it. Experiments in which flaps of bark were separated from the wood showed that changes in the wood were due to lateral transport from the bark to the wood, since they only occurred when bark and wood were in contact.

Mason and Maskell gave evidence in the first Memoir showing that carbohydrate moved in the bark in response to a concentration gradient. The close resemblance between the responses of carbohydrate and of nitrogen to partial and complete ringing suggested that there should be a gradient basis for nitrogen transport. The greater part of Memoirs II and III is devoted to the investigation of this possibility, which resolves itself into two main lines—the localisation of the actual channels of transport of organic nitrogen in the bark and the identification of the types of compounds taking part in transport. The results are more interesting, although less conclusive than those obtained with carbohydrates. Carbohydrates were found to move down a concentration gradient—nitrogen was found to move against a concentration gradient. Cessation of movement of carbohydrate was associated with the disappearance of the carbohydrate gradient, but cessation of movement of nitrogen was associated with a distinctly negative gradient of both protein and crystalloid nitrogen. Removal of all the leaves from a plant caused a steepening of the originally negative gradient. Reversal of the direction of normal movement, *i.e.*, organic nitrogen moving from base to apex, caused a further steepening of the negative gradient.

* Memoirs of the Cotton Research Station, Trinidad. Series B. Physiology. Nos. II and III.

On the basis of these results the authors postulate two gradients in the bark, a dynamic gradient of translocatory nitrogen, which is normally positive, causing a flow of organic nitrogen from the foliage region to the roots, and a static negative gradient of storage nitrogen. The term static is only relative, since under conditions in which the nitrogen supply is inadequate, the storage nitrogen may be translocated to the regions of nitrogen shortage. The dynamic gradient responded to manipulation and it could be reversed by allowing the base of the plant to act as a source of supply to the top. Reversal of the dynamic gradient produced a greater change in the inner half of the bark, which suggests that the sieve-tube is the actual channel of transport. If this is correct, then the sieve-tube is the channel of transport for both nitrogenous bodies and carbohydrates.

The types of nitrogen compounds responsible for transport and for storage in the plant have long attracted the energies of investigators. The rôle of asparagine has created the most discussion. One view, of which Chibnall is the most recent supporter, is that asparagine is utilised both for translocation and for storage. The other view, supported by Prianischnikoff, is that asparagine takes no part in translocation but is utilised only for storage. Data recorded in Memoir II on the concentration gradients in the bark and on the radial distribution of asparagine in the bark supports Prianischnikoff's view. The dynamic nitrogen gradient in the bark was found to be due principally to protein nitrogen and amino acids. If protein nitrogen can take part in transport, then the transport must necessarily be confined to the sieve-tubes, for only the sieve pores offer a path for such big molecules as those of protein.

Möthes, in an investigation of the nitrogen relation of the leaf, found that they were dependent on the moisture content of the leaf. Desiccation brought about a rapid change of protein to crystalloid nitrogen. This is paralleled by the observation of Arhns on the effect of the moisture content of the leaf on the starch-sugar ratio—desiccation favours sugar production at the expense of starch. Maskell and Mason have extended Möthes' observation on the lability of the nitrogen compounds of the leaf to the bark—"conversion of crystalloid to protein nitrogen in the bark may be rapid compared with the longitudinal transport of nitrogen." There is, however, this difference between the two observations. Möthes found that desiccation favoured the production of crystalloid nitrogen, whereas in the bark the converse appears to hold. In view of these rapid changes, Maskell and Mason believe that all the nitrogen fractions found in the sieve-tubes may take part in longitudinal movement. A very interesting observation arises from this conclusion—that the rate of movement of nitrogen in the sieve-tubes bears the same relation to the rate expected from "in-vitro" diffusion data as was found for carbohydrates—the mechanism accelerating diffusion in the sieve-tubes acts impartially on nitrogenous bodies and on carbohydrates.

The fifth paper of the series is devoted to the boll; to the mechanism by which nutrients reach it, the route by which they travel, and to the manner in which they are utilised on arrival in the developing boll.

The last paper contains a summary of the authors' views on the transport of carbohydrate and of nitrogen in the cotton plant, which cannot be better described than in their own words. "For nitrogen as well as for carbohydrate transport there seems to be a gradient basis. For carbohydrates the head in the leaf is apparently reducing sugars, while for nitrogen the head is residual nitrogen. Within the sieve-tubes all the soluble carbohydrates and all the labile forms of nitrogen, including protein, should contribute to longitudinal transport, the part played by each depending on the effective concentration gradient maintained, and probably also on the diffusion constant. The mechanism (possibly protoplasmic streaming) which is responsible for accelerating diffusion along the sieve-tubes should act impartially on all materials that are free to move."

The high standard of experimental work and care in the interpretation of results set in the earlier work on carbohydrate transport has been fully maintained in this more difficult investigation on nitrogen transport. The problem is greatly complicated by the realisation of the lability of the various types of nitrogen compounds. The reasons underlying these rapid changes are quite obscure. Perhaps the greatest disadvantage of any investigation of nitrogen metabolism as compared with carbohydrate metabolism is the absence of any knowledge concerning the identity of the compounds taking part in transport and in temporary storage. When this disadvantage is overcome, and when some method is discovered of obtaining the contents of the sieve-tubes in reasonable quantity, without contamination from surrounding tissues, then some definite advance may be made in this intriguing problem.

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BOTULISM IN ANIMALS.

[*The following is abstracted from a paper by Captain H. V. M. Metivier,* O.B.E., B.Sc., M.R.C.V.S., *Government Veterinary Officer, published by the Department of Agriculture, Trinidad and Tobago.*]

Botulism, *bacillus botulinus*, also known as forage and fodder poisoning, sleepy staggers and cerebro-spinal meningitis, is microbic in origin and thus resembles contagious diseases such as anthrax, tuberculosis, &c., but with the important difference that it is not necessary for the microbe to attack the animal directly—that is, to invade its body—it is in the food and there only that the microbe does its deadly work. The organism is usually found to grow and multiply with microbes that cause decomposition and putrefaction, but of itself it has little decomposing ability. Four distinct types of the microbe are known to exist and although the symptoms produced by all types are identical, differences exist in the toxin (poison) produced by each type of the microbe. The anti-toxin to one type will not protect against toxin of another type and as far as it is known at present all types are toxic for ordinary farm animals.

Nature of the Disease.

The disease may be defined as a condition caused by eating fodder which has become poisonous or toxic through the growth in the fodder of the microbe (*Bacillus botulinus*) or it may be caused by animals drinking water in which the toxin has been dissolved. Small pools on infected pastures serve as excellent spots for the concentration of the toxin. The disease is neither infectious nor contagious and at the Government Farm affected animals have been put with healthy ones with negative results.

Bacillus botulinus is a saprophyte; that is, an organism which may be found in soil, dust or water and ordinarily lives therein obtaining its nourishment from decomposing vegetable matter. The organism appears to be widely distributed in Trinidad soils as within the last five years the disease has been observed in all parts of the Colony. The mere presence of the organism, however, is not in itself sufficient to produce the disease as special conditions for its multiplication must be present, the chief being warmth and moisture. Any kind of fodder may at times be possessed of this poisonous property. The organism does not make fodder appear in any way unwholesome, but conditions that favour its growth also encourage the growth of other organisms, particularly moulds, and thus the organism is frequently found growing in mouldy fodder. The degree of warmth necessary is found throughout the year in Trinidad, but the moisture requirements are best provided in the rainy season. Thus the disease is especially liable to be met with after grazing lands have been exposed to heavy rains after a hot spell, and again followed by bright sunshine—in other words humid conditions. Although the disease may be found in stabled animals the experience in Trinidad is that in the great majority of cases the incidence of the disease is highest in animals that are totally pasture-fed. As the organism multiplies in the environment of decomposing materials, it may be asked how grass lands can become dangerous. A moment's reflection will show that whereas closely cropped or mowed grass would not be likely to be dangerous, long grass, particularly the rank growth found on wet land may easily contain much dead material, both leaf and stalk, and such grass may be damaged and mouldy about the butt.

Among poisons the Botulinus toxin is the most powerful. It is very soluble in water and so is easily washed from place to place. Fodder which appears quite sound may have washed into it sufficient of the poison to cause the disease. The disease may also be contracted by animals drinking water that has percolated through decomposed and mouldy vegetation.

Symptoms.

The course of the disease depends on the amount of toxin the animal has absorbed and for purposes of description two forms can be recognised: the acute and the chronic, there being all degrees of severity between the two. The outstanding feature in all cases, however, is the inability to swallow food and it is the one symptom upon which chief reliance should be placed for diagnosis. In the acute form where a large quantity of the toxin has been absorbed the onset is sudden and the course rapid; there is at first, listlessness, slight inco-ordination in gait and clumsiness in eating. Then follows the typical symptoms of paralysis of the tongue and the muscles which perform the act of swallowing, salivation being marked at this stage. At times these symptoms may pass unnoticed especially if the animal is not under close observation. The paralysis of the tongue and throat muscles is followed by complete loss of co-ordination of the limbs and the animal goes down. There are no symptoms of pain but the animal struggles to regain its feet without success displaying a paddling action with both fore and hind limbs. Affected animals are usually constipated and the temperature is usually normal. The animal may lie on the ground three or four days before death supervenes and is conscious almost to the end. In the chronic form the animal does not go down so quickly, it is dull and listless, shows a disinclination to move and when made to do so there is distinct inco-ordination of movement. Salivation and nasal discharge are present and the animal may be able to swallow a little moist food, but portions of the food may drop from the mouth. The animal eventually goes down and may live for several days paddling and struggling to regain its feet.

Treatment.

No method of treatment can be relied upon. Animals can be immunised against the condition by means of an anti-toxin, but this is very costly

and the immunity of short duration. Also, with the disease affecting such comparatively small numbers of animals, and being of uncertain occurrence, immunisation is not a practical measure for its control. The disease can be kept under control by stall-feeding the animals instead of turning them out to pasture or tethering them out to graze. If stall-fed animals are affected, the fodder should be cut as high as possible from the roots, and preferably an attempt made to obtain grass from a different area. As the disease is more prevalent in the rainy season, both the stock and grazing should be closely supervised during that period.

Where the pastures are affected the condition can be kept in check by mowing the area, draining the land and filling up any holes which might collect decomposing vegetable matter.

CACAO POLLINATION.

[*Published below is a report by Mr. J. C. Haigh, Assistant Mycologist, Department of Agriculture, Ceylon, on germination tests which he has made with cacao pollen with the object of investigating a possible cause in the sterility of cacao trees.*]

GERMINATION tests have been carried out with pollen from a sterile cacao tree at the Experiment Station, Peradeniya. The tree bears abundant flowers but has never been known to set a pod. Comparative tests were carried out at the same time with pollen from a tree (No. 5 "B" cacao) that in the last three series of yearly records has produced respectively 119, 108 and 105 pods.

The flower of *Theobroma Cacao* opens in the early morning; advantage was taken of this fact to ensure that only fresh pollen was used for the tests. In the evening all opened flowers were removed from one branch of each of the trees under examination, thereby assuring that the flowers picked for experiment next morning were newly opened. The flowers were picked in the early morning and the pollen from them was sown on 1.5 per cent. agar in petri dishes. Five flowers were taken from each tree per day and the pollen from each anther was sown separately; twenty-five pollen masses per tree per day were thus obtained. Normal pollen germinates in a few hours in a moist atmosphere, but for convenience the pollen was examined twenty-four hours after sowing. Germinative power was judged by the percentage of pollen grains that had produced a germ tube. From the good tree, 4,664 pollen grains were examined, of which 3,379, or 72.4 per cent., had produced a germ tube in twenty-four hours; from the sterile tree 4,191 pollen grains were examined, of which only 15, or 0.36 per cent., had germinated in the same length of time. Samples of pollen from the sterile tree were kept for five days, but no increase in germination percentage was observed. Pollen from the good tree was seen to germinate a few hours after sowing. The only observable difference between the pollen from the two trees was that from the sterile tree contained a small percentage of larger, thin-walled grains. The normal pollen grain examined was about two μ in diameter and had a thick wall; the larger grains had a thin wall and were about 30 μ in diameter.

The above tests show that the failure to germinate of the pollen of the sterile tree is a factor responsible for the sterility of the tree, since self-fertilisation is impossible. It is generally held that the cacao flower is in the main self-fertilised, but Harland* has shown that cross-fertilisation occurs in cacao; it is still necessary, therefore, in accounting for the complete sterility of this tree, to explain the failure of cross-pollination. A detailed investigation will probably be necessary before this explanation is found; in the meantime a few simple hand pollinations have been made, using pollen from the good tree of the germination tests. It is perhaps of interest to note that similar tests carried out in the West Indies failed to show a significant difference in germinative power between pollen from good and poor yielders, and that in such trees, which were incidentally the progeny of the same parent, sterility was due to a defect in the female part of the flower.

* S. C. Harland, Studies in Cacao, Part I. The Method of Pollination. (*Ann. Appl. Biol.*, XII., 1925, p. 403.)

STUDIES IN WEST INDIAN SOILS.

The Cacao Soils of Tobago.

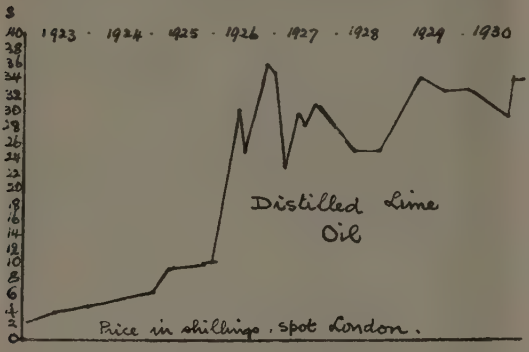
THIS paper which is printed in the form of a Supplement (price 2*s.*) to this issue of the Journal, describes preliminary work on cacao soils of Trinidad and Tobago. It is published because the work forms a concrete whole, which yielded some definite information as to the nature of the differences that contrast "good" cacao soils with "bad." The parent material from which the cacao soils of Tobago have been formed belongs to two main types of rock, which uniformly comprise the hilly land of the Island, namely (*a*) a basic igneous rock, and (*b*) a metamorphic schistose rock. These types, together with their derived alluvial equivalents, have given rise under the medium rainfall of Tobago, to immature, not very profoundly differentiated soil profiles of a general grey colour. The main factor that differentiates "good" and "bad" cacao soils appears to be the mineral nutrient status, which is bound up with the composition of the organic residues incorporated in the upper soil layers and their rate of decomposition. Work in progress in Trinidad should throw further light on these relationships, and should furnish additional evidence on which to test the generalizations suggested by the soil examination within the less complicated area growing cacao in Tobago.

F. H.

DISTILLED LIME OIL.

[*The following abstract from an article by A. C. Stirling published in the "Perfumery and Essential Oil Record," Vol. XXI, No. 12, is reproduced below.*]

THE phenomenal increase which has taken place in prices of Lime Oils since 1923 and 1924 has puzzled many people, and especially those who have not followed the position very closely, and have tried to reason about it as they can do about many other essential oils. The graph showing



price fluctuations since 1923 certainly needs a deal of explaining. Consumption has been drastically curtailed by the price factor, and, during the past year by the general trade depression, yet prices are to-day very nearly as high as they have ever been. The following brief survey of the industry is written in the hope of elucidating this extraordinary position.

For practical purposes the British West Indies can be considered as the only source of Lime Oils on a commercial scale, and the history of the industry has been one of many disasters. The Lime is not indigenous to these Islands, and the date of its introduction is uncertain. It was probably about 1750 and certainly before 1800, but it was not until the middle of last century that Lime cultivation became at all important. The industry was at first confined to the Island of Montserrat where it flourished until the hurricane of 1899 very nearly wiped it out. It was ten years before it recovered from this setback.

In the meantime, however, the cultivation had spread to Dominica where large areas were planted at all levels from the coast up to 1,000 feet above the sea. Progress was rapid during the first decade of this century, although the attacks of Scale disease in the middle of the period were rather disturbing.

The industry began to attract a great deal of attention, and the neighbouring Island of St. Lucia started to plant vigorously. Much unsuitable land was utilised and between 1910 and 1920 many plantations proved to be failures, but the remainder carried on and the production of Lime products—although not comparable with that of Dominica—became an important factor in the Island's welfare. All went well for the next few years until, in 1923 and 1924 "Wither-tip" made its appearance in Dominica, and subsequently spread to St. Lucia.

The resulting reduction in output of oil was the cause of the steady rise in price which occurred during 1924 and 1925. American prohibition probably accentuated the movement by increasing the demand, not only for the oil itself, but also for green Limes. Grenada, Trinidad and Demerara produced enough limes which alleviated but did not replace the shortage of production in Dominica. Fluctuations in price during the following two years can be accounted for by seasonal requirements, periodical pressure to sell and to take advantage of the satisfactory prices obtainable, and, in part to defective selling arrangements by the various interests.

Then in 1928 came the hurricane which again fell heavily on Montserrat and did much damage in Dominica. In this latter Island its full effects were not immediately apparent, but very soon "Red-root" made its appearance, and began to take a heavy toll especially of the larger and older trees.

These are the conditions under which the industry has struggled during the last two years. In the meantime experiments have been made in the planting of immune varieties of which those grafted on to sour-orange stocks have proved far and away the most successful. It still remains to be seen, however, whether these new varieties will produce the same qualities of juice and oils as the old trees have done.

Last summer the demand for Lime products began to fall off in common with that for other agricultural products, and consumers saw visions of rather lower prices, but at the beginning of September Dominica was visited by the worst hurricane experienced there in living memory. The whole of the Island's crops for the rest of the year were lost, and the Lime trees left by the "Red-root" disease were uprooted. The damage to, and cost of replacement of, permanent cultivation is estimated at a quarter of a million sterling. The only bright spot appears to be that the new Lime trees on sour orange stocks were unaffected, but as these cannot produce fruit for the next few years and will not be in full bearing for at least another five years, it does not much affect the present position.

This short survey may, perhaps, help to explain the course of the market during the last few years, and the present high prices.

One more point is worth mentioning as a possible guide to the future. Distilled Lime Oil is produced in the manufacture of concentrated juice from which Citrate of Lime is made. Sicily is the largest producer of this article, and at the moment holds enormous stocks which are unsaleable even at to-day's abnormally low quotations; whether the inevitable reduction to still lower levels will succeed in liquidating them is problematical. This has reacted, and must continue to do so, on

the price of concentrated lime juice, and consequently Distilled Oil, once the bye-product, has now become the more important of the two, and has to bear almost the whole cost of the fruit and the process. Prices for green Limes and raw juice admittedly stand at comparatively low levels, but nevertheless they are more attractive and remunerative than the preparation of the concentrate unless a very high price can be guaranteed for the oil. Unless the price of Distilled Lime Oil remains at a high level it will cease to be manufactured.

SUGAR-CANE SOILS IN JAVA.

Recent Work on Sugar-Cane Soils in Java.

[*Note.—The following abstract, describing the pioneering work of O. Arrhenius, in Java, is taken from an article by Dr. E. M. Crowther, Head of the Chemistry Division of the Rothamsted Experimental Station, and published in the "Annual Report on the Progress of Applied Chemistry,"* 1929, p. 553. —EDITOR.]

A new method of approaching soil problems in tropical agriculture, is well illustrated by the work of O. Arrhenius in Java. As a starting point in this work, there was available abundant precise information on yields and soil fertility supplied by the several thousand field experiments, each with 10 to 12-fold replication, carried out annually by the Experiment Station of the Java Sugar Industries at Pasoeroean. The scale on which this station works may be appreciated by the fact that from subscriptions at the rate of some 5s. per acre it obtains an annual income exceeding £100,000 and its success by the fact that in the last few years its new variety P.O.J. 2878 has yielded some 30 per cent. more than the best of its forerunners. A single pure variety is now grown over the whole area, the yields are accurately known, and at a very large number of points the effects of special cultural or manurial treatments are known with a high degree of accuracy. The situation calls for the experimental and statistical method of attack. Arrhenius, therefore, sought for very simple, rapid, and inexpensive methods of characterising soils which would correlate closely with the yields, behaviour on cultivation, and response to manuring for some thousands of samples of sugar-cane soils, and then used the more promising ones for preparing soil maps based on the analyses of samples taken from every hectare of the plantations. The few liming experiments conducted gave positive results, and optimum growth in culture media was obtained at pH 7; in the field there was general falling off in yield with decreasing pH. This relationship is probably associated with the fact that the phosphoric acid soluble in citric acid was also closely connected with the reaction; it increased rapidly from pH 6.2 to 6.5, remained constant from 6.5 to 7.5, and then increased again. The rate of nitrification was not dependent on pH value, but increased fairly regularly with the citric-soluble phosphoric acid, except in the richer soils. Ninety per cent. agreement between field response to phosphates and laboratory tests was obtained by applying the rule that soils with less than 0.009 per cent. P_2O_5 soluble in 2 per cent. citric acid required phosphate, those with more than 0.027 did not, the intermediate ones being doubtful. Closer agreement was obtained by determining the phosphoric acid soluble in a dilute salt solution. Nitrate-producing power under laboratory conditions gave a better criterion than nitrate content, and was sufficiently closely connected to nitrogen deficiency in the field to be used in practice. The acidifying effect of ammonium sulphate was unimportant except in the most acid soils. Some cases of soil infertility were ascribed to too high chlorine concentration, and the prevalence of a root-rot could be correlated with certain physical properties and nitrifying power, but not with the reaction or phosphate supply. Concurrently with the field tests, experiments on the nutrition of the sugar-cane were carried out in sand and soil cultures with flowing solutions.

BAMBOO PULP.

THE Progress Report of Forest Research Work in India for the year 1928-29 shows that good progress has been made in the production of bamboo pulp and paper, which will have no doubt an important bearing on India's pulp and paper industry in the future.

It is now known that first class bamboo pulp can be manufactured at a cost which can compare favourably with the cheapest chemical pulp on the world's markets, and during the year under review several tons of bleached and unbleached bamboo pulp were supplied to interested firms to test the paper making qualities of bamboo fibres, while a consignment of specially prepared pulp was also sent to a London firm to test its suitability for the manufacture of artificial silk. A Bombay firm has reported very favourably on the dyeing properties of bamboo fibre, bamboo pulp being found equal to the best wood pulp in its behaviour with organic dyestuffs of all colours. Bamboo paper has been supplied to the Government Press at Delhi and Simla and paper was also made for the varying requirements of the offices of the Forest Research Institute and College at Dehra Dun.

The movement towards the establishment of the bamboo pulping industry in India has made distinct progress. A lease for the Angul reserved forests of bamboo was granted to a Calcutta firm, and two substantial financial groups in London were also reported to be maturing plans for the exploitation of the Arakan and Tenasserim areas in Burma for the manufacture of bamboo pulp. The total result of work at the experimental factory in India can best be realised when it is pointed out that manufacturing costs have been reduced by £10 to £15 per ton for unbleached pulp at this factory.

TROPICAL WORLD NOTES.

The Seychelles.

According to the Annual Report of the Department of Agriculture for 1929 the production of coconuts was reduced by three million nuts as compared with the previous year's crop; this being accounted for by attacks of scale insects following upon dry weather. Of late years these attacks have become much more severe, the two insects involved being, the yellow scale (*Pinnaspis buxi*) and the thread scale (*Ischnaspis filiformis*). Methods of control suggested include the importation of coccinelid beetles and of certain entomogenous fungi. On many estates attempts have been made to improve cultural methods, and the terracing of steep land to prevent erosion by means of walls and trenches with additional rows of cover plants has become a regular practice. An agricultural survey of the area under coconuts revealed that the total acreage under this crop was 28,240 acres with a production of nearly 36½ million nuts. Coconuts are grown on the coral as well as the granitic islands; production on the former amounting to as much as 4,000 nuts per acre and on the latter rarely exceeding 1,000 nuts per acre. The vanilla crop was the best on record since the last four years but the cultivation of this orchid is not at present a paying proposition. The production of essential oils also rose, the chief products being cinnamon leaf oil, patchouli and clove leaf.

* * *

Swaziland.

According to Colonial Report (No. 1501) for 1929, at the end of the year there were approximately 74,000 European-owned cattle in the territory and 306,000 native-owned, total 380,000; or about one head per 11 acres. 13,312 head of cattle were exported to the Union for slaughter purposes. Of this number, 8,843 went to the Johannesburg abattoirs and the remainder, 3,469, *via* Gollel and Zululand to Durban. As in the past the work of the Veterinary Department was directed against the spread of East Coast Fever. At the beginning of the year there were two infected areas one of which was released from quarantine. Two new outbreaks occurred and 72 head of cattle died out of 8,200. Early measures and short interval dipping as well as hand-dressing are the secrets of success in dealing with East Coast Fever.

The cotton crop shows an improvement each year, and although the acreage under cultivation was less, returns were greater, due to the improved type of seed and especially to the jassid-resisting varieties introduced by the Empire Cotton Growing Corporation. As more of the improved seed becomes available larger quantities will be grown. Climatic conditions were not unfavourable and insect pests were markedly less. An area of 1,870 acres of tobacco was planted with a considerable improvement in quality. Maize, kaffir corn, beans and ground nuts yielded fairly good returns.

Fiji.

According to the Colonial Report for 1929 (No. 1497) trade showed a slight decrease in imports and a decrease in exports to the value of nearly a million pounds. Agriculture is the only source of the Colony's wealth, sugar-cane being the most valuable crop, with coconuts and bananas next in importance. Rice is grown extensively for home consumption, the bulk of the crop being milled at the Government Rice Mill. Pineapple canning is a young industry which promises to become of considerable importance, two pineapple companies are already operating in the Colony, and a third is conducting experiments with a view to beginning operations on an extensive scale. Dairying and stock-raising are industries which are being built up in districts not suited for sugar or copra cultivation, and are capable of considerable expansion. The output of butter is increasing steadily and export markets are being explored.

During the year under review the output of the Colony's five sugar mills was rather less than 90,000 tons, a figure somewhat below normal, and due mainly to dry weather conditions. In common with other British Colonies which produce sugar, Fiji felt the severe depression which has existed in the world's markets for the past year, and without the preferential treatment granted to Empire sugar in the markets of Great Britain and Canada the position of the industry would have been serious. The policy of sugar manufacturers in subdividing their estates into 10 to 12 acre farms, which are leased to peasants, has been continued. The results obtained may be considered satisfactory, seeing that production has been maintained, but there is still scope for further activity in this direction as the agricultural population increases. At the present time 75 per cent. to 80 per cent. of the crop is produced by Indian farmers growing cane on land leased either from the native owners or the mill proprietors, and encouragement is also being given to Fijians to extend their cane growing operations.

The increase in the export of copra was largely due to the successful campaign of pest control and of improved cultural methods for native plantations actively pursued by the Coconut Committee and its staff. The major pest of coconuts, *Levuana iridescens*, is now definitely controlled, and the position in regard to scale (*Aspidiotus* sp.) is improved. The scientific staff of the Coconut Committee is now engaged on the control of the Spathe Borer (*Tirathaba trichogramma*) and the Leaf Miner (*Promecotheca reichei*).

PLANTER'S DIARY.

We have received from the Dominions Potash Supply Co., Ltd., 41, Eastcheap, London, E.C.3, a pocket size diary which contains much useful information of interest to planters. Copies of the diary can be obtained gratis on application to the above firm.

ENTOMOLOGICAL NOTES.

Compiled by the College Department of Entomology.

Preservation of Books in the Tropics.

In order to minimise the serious damage caused to books and documents by insects and moulds in the tropics, the bookcases must have closely fitting glass doors and contain the vapour of some volatile chemical deterrent, and the books should be treated with a suitable protective poisonous material.

The following procedure has been recently adopted with success in Fiji. The books are fumigated with hydrocyanic acid gas, and a solution containing 1 oz. mercury bichloride, 1½ ozs. carbolic acid and 1 quart methylated spirits containing pyridene as one of the denaturing agents is painted on both sides of the covers and generously along the seams dividing the covers from the printed material. This solution must be stirred continually as the mercury bichloride has a tendency to settle out. After it has dried, a varnish containing 1 oz. shellac dissolved in 8 oz. methylated spirits, to which has been added 3 drms. creosote oil, is painted on in the same manner, a small amount being added to the extremities of the pages, while the books are closed. The shelves of the bookcase are similarly treated and porcelain dishes containing paradichlorobenzene are placed on them. Holes drilled in the shelves at regular intervals to hold containers for paradichlorobenzene would be preferable. Cardboard boxes in which papers are stored should be treated inside and outside with both solutions, and an envelope containing paradichlorobenzene should be placed in the box or fixed inside the lid. This treatment once a year should be sufficient, but this has not yet been proved.—(*The Review of Applied Entomology*, Vol. XVIII, Ser. A., Part II.)

* * *

Introduction of *Liothrips urichi* into Fiji.

A brief account is given in the *Fiji Agricultural Journal* (iii, No. 2), of Mr. H. W. Simmonds' visit to Trinidad beginning in October, 1929, as a result of which a large consignment of *Liothrips urichi*, Karny, was sent to Fiji in February, 1930, to control *Clidemia hirta*. The consignment reached Fiji on 13th March and in the course of a week 5,000 adults were obtained from it, 3,400 of which were released in the field and the rest kept in cages in order to breed a large supply of the thrips. The methods of breeding, transporting and releasing the thrips are described. It was found to be attacked by a number of natural enemies in Trinidad, including the larvae of a Cecidomyiid, which probably destroyed 30 to 40 per cent. of the nymphs, the Chalcid, *Tetrastichus thripophonus*, Wtrst., a mite and predacious Rhynchota. The author discusses the other natural factors affecting *C. hirta* in Trinidad, and considers that the effect of *L. urichi* in destroying the seeds may have been overestimated, because the same scarcity of seeds was observed in plants growing in wet districts or under shade, on which it was rare or absent, and in other species of *Clidemia*, which are not infested by it. The seeds were found to be attacked by a number of other insect enemies, including a Chalcid, which sometimes infested as many as 95 per cent. of the fully grown berries, and various Lepidoptera, which feed either internally or externally. Several leaf-feeding insects were observed, but it would not be safe to introduce these into another country.

A brief visit was also made to British Guiana, from which country *C. hirta* is supposed to have been introduced into Fiji before 1890. The form of *C. hirta* found there more closely resembles the Fijian one than that of Trinidad, but this may be due to soil conditions. A thrips similar to *L. urichi* occurred on it in small numbers.—(*Review of Applied Entomology*, Vol. XVIII, Ser. A., Pt. II.)

* * *

The Biological Relationship between *Septobasidium* and Scale Insects.

As a result of a long series of observations and experiments on *Septobasidium retiforme* (B. & C.) Pat. and other species, it has been found that the fungus and scale insects live symbiotically at the expense of the host plant. The fungus-insect relationship is *perennial*, depending only upon the life of the tree. The fungus furnishes a home and protection for the scale insects. In some species this " fungus house " is specialised with a remarkably high degree of perfection and beauty. The scale insects, protected by the fungus, suck the juices of the plant, grow, and finally reproduce their young in vast numbers. These young may pursue one of three courses: (i) they may settle down beneath the same fungus under which they were born and repeat the cycle; or (ii) they may crawl to other fungus-insect colonies; or (iii) they may crawl out and settle down on the clean bark. The latter insects are entirely responsible for the dissemination of the fungus. Certain young become infected soon after they are born. The manner of infection; the development of the fungus within the bodies of the young; and the final growth and establishment of new fungus-insect colonies were described.

In return, a number of the scale insects are parasitised by the fungus. Parasitised insects are proportionately much more abundant during the late spring and summer months than during the fall and winter months. The type of parasitism is of a highly specialised nature. The fungus enters the circulatory system of the living insects and there develops numerous coils which absorb food from the insect. A number of insects are finally killed and used up by the fungus; others, though infected, may digest the fungus haustoria and survive to reproduce, and some are free from any infection.

Finally, a comparison of certain familiar examples of symbiosis were made with the conditions here reported in *Septobasidium*.—(*Fifth International Botanical Congress, Cambridge.—Abstracts of Communications.*)

SUGAR NOTES.

Compiled by the College Department of Sugar Technology.

Seeding Low-Grade Massecuites, by *G. F. Murray.*

In factories having a shortage of pan capacity for low grade it is essential that such capacities are utilized to the best advantage. In the author's case, he has only one low grade pan of 425 cubic feet capacity ; and, as he is forced to boil at least two strikes every 24 hours, it is readily seen that there is very little time left for boiling seed. Two years ago he developed the following method, which not only saves a very considerable amount of time, but also gives a very uniform sized grain in the finished product. Enough "C" molasses is drawn into the pan to cover the calandria. This is boiled under slightly reduced vacuum (24-25 in.) to heavy string proof (92-93° Brix). As soon as this point is reached, the steam is shut off, injection water increased to raise vacuum to normal, and 1 lb. of screened, powdered sugar is drawn into the mass. After 10 to 15 mins., when the grain is large enough to be seen with a small tripod microscope, the steam is again opened and the strike fed with small charges of syrup and molasses, tightening up between charges, until the grain has reached the proper size, after which the strike is finished to 200 cubic feet on molasses, and struck at about 90° Brix to a receiving tank below ; 200 cubic feet of seed is sufficient to seed from eight to sixteen strikes, depending of course on the size of grain. With this system the author frequently boiled a full strike in eight hours, including drawing up seed and steaming out the pan.—(*International Sugar Jr.* Vol. XXXII, No. 383.)

* * *

Sugar in Jamaica, 1929.

Deficient rainfall and low prices made a poor year for the sugar-cane planters. The result was a considerable shift from cane to bananas. However, most of the sugar estates covered expenses or even made a small profit due to improved cane yields, although measures for temporary relief were necessary towards the end of the year when the price of sugar fell below the cost of production. The variety P.O.J. 2725 has been found highly resistant to mosaic and is being extensively used in preference to Uba in infected areas. B.H. 10 (12) and Ba. 11569 continue to give good results ; S.C. 12/4 is very promising. E.K.28 has averaged as much as 78 tons per acre on one field ; this variety appears not to be seriously affected by mosaic in some districts but is severely attacked in others. The above mentioned varieties greatly exceed the yields from White Transparent, but the latter still occupies a fourth of the total cane area. The P.O.J. varieties 213 and 234 are considered failures in Jamaica. H. 109 succeeds only on light soils with adequate water supply.

The demand for high flavoured Jamaica rum was good at satisfactory prices, but ordinary rums were slow of sale and low in price.—(*Facts About Sugar*, Vol. XXV, No. 27.)

Improvements in Milling Equipment. *Rene Weil.*

During the past few years the capacity of mills in Cuba has increased considerably, so that the rate of 200,000 arrobas (2,260 long tons) in 24 hours formerly considered a maximum for a large tandem has to-day increased to 500,000 arrobas (5,650 long tons) with an appreciable increase in the extraction. These results have been due to improvements in constructional details of the milling equipment. Amongst modifications in mills one may cite the increase in rotating speeds, increases in the size of roll groovings, adoption of McNeil type of tooth profiles, generalization of Messchaert deep juice-grooves, application of compression rolls to equalize the blanket thickness, increase of pressures on roll shafts and notable improvements in imbibition. These improvements have come hand in hand with mechanical and lubricating refinements, without which continuous and uniform crop operation would not be possible, if one considers the enormous pressures and accelerated speeds now prevalent. Shut-downs from choked mills, hot journals and other accidents and incidents springing from insufficiently perfected mechanical design would doubtless limit the working capacity of Cuban milling equipment. Modern devices of present-day milling equipment are now summarily described : *Steel Housings.*—The construction of steel housings, doing away with the need of large transverse bolts, allows a closer approximation of lower rolls, thus reducing the width of the turn-plate to a minimum. A rocking turn-plate is the most resistant, but, at the same time it must be sufficiently large to encompass the radius of oscillation so that after the abrasion of the wearing sides has set in the inclination of the turn-plate be slight and normal operating conditions of the mill suffer no variation. To attain these desiderata it is indispensable to build cast steel housings in a single block, reaching to the foundation, thus allowing the greatest possible radius of gyration to the turnbeam.

Hydraulic Pressure.—Mill and crusher hydraulic caps are designed for the double purpose of reducing leather wear to a minimum and, simultaneously, allow the quick and easy replacement of leathers. Hydraulic pressure rams move within well-fitting bronze lined cylinders of considerable length, thus lessening the tendency to wedge tight under the strain of the oblique movement of the rolls and the irregularity of the reactions of the rolls amongst themselves, while reducing wear to a minimum. This action is completed through methodical lubrication fed under the leathers and conveyed by grooves toward parts where friction is greatest. It is evident that the lubricating action of the hydraulic pressure oil cannot be relied upon at all, since this oil is completely absorbed by the leather ; betwixt leathers and cylinders no lubrication exists, thus provoking rapid deterioration of the leathers. On the other hand the leathers employed are of the best quality, appropriate for the task required of them. Leathers in mills of modern construction have a much greater useful life than formerly and there

are instances where leathers have worked during four consecutive crops without replacement. Hydraulic caps, in turn, are built to allow easy replacement of leathers, with minimum lost time. To do so it is necessary merely to unscrew a light-weight plug, change leathers and screw the plug in again, an operation requiring a few minutes. The thread is of a special cut which prevents adherence under the action of the heavy pressures involved, so that the loosening operation is effected without the need of special wrenches. Therefore, there are no heavy pieces to dismount nor bolts to take out, thus economizing time and work to effect changes when necessary.

Hot pressing of shells.—Hot pressing of shells on shafts, along the entire length of the roll, is an extraordinary advantage. This system precludes the use of pins, wedges, bands and flanges, &c., necessary with other processes to avoid slippage or striating of shells on shaft. Failure of such has depended solely on a deficient technique of the system in question, since the record available covers hundreds of rolls built according to this technique of hot fitting, without a single protest by mill operators and without one case of slippage or broken shells. Shop work must be executed with extreme care and this can be obtained only with special high pressure devices, appropriate tools and able and expert personnel trained to this type of work. Any difference of a few hundredths of a millimeter may completely alter the elements of resistance of the parts, or the solidity of the fit. Material must be first class. Shafts should be of semi-hard Siemens-Martin steel, and the shells of special cast-iron, the metal being, above all, very homogenous and of uniform grain. With the hot fit system nothing acts to modify the efficiency of the adjustment previously fixed. The surfaces of contact, neither previously lubricated, nor subsequently glazed, as a result of the operation, have a very high coefficient of adherence. Also, the slight roughness of the resulting from the machining operations interlock, still increasing the adherence to a much higher extent, so high in fact that it is practically impossible using a press to extract from its shaft a mill shell correctly mounted by the hot fit method. It is necessary in fact to break the shell.—(*Int. Sug. Journ.*, Vol. XXXII, No. 384.)

* * *

Removal of Colloids with Bentonite. *R. E. Lothrop and H. S. Paine.*

Cataphoresis measurements show that the colloidal particles of most honeys are positively charged and that reversal of the charge can be brought about by increasing the pH of the solution. An iso-electric point is reached when the particles show no charge, and at this point maximum precipitation of colloidal material takes place. Determinations of the iso-electric point gave very nearly the same value, namely pH 4.3. Above this the colloidal particles are negatively charged, and below positively. Coagulation of colloids can be brought about by the addition of Bentonite, a colloidal clay whose particles are negatively charged. The action is one of mutual precipitation of oppositely charged colloids, and results in a brilliantly clear honey, which is lighter than the original honey in colour. This process for "clarifying" honey promises to be valuable as a means of bettering the quality of some low-grade honeys.—(*Int. Sug. Journ.*, Vol. XXXII, No. 384.)

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Some Notes on Cooling Coils in Crystallizers, by *J. E. Biela.*

As both the crystallizer and centrifugal capacities at the Kohala factory are limited, five of the ten crystallizers were equipped with cooling coils. As much of the cane for the last six weeks of grinding came from lowlands, exposed to salt spray, with juices of very low purity and molasses of high viscosity, it was necessary for the factory to do considerable blank boiling for low grades. They found that grained strikes, under these conditions, take considerably more time for drying, and the following tabulation shows the average of a few representative strikes, both grained and boiled blank, cooled with and without the use of cooling coils :—

Massecuite		*Molasses*	
Brix	*Apparent*	*Brix*	*Apparent*
Degree.	*Purity.*	*Degree.*	*Purity.*
97.58	56.45	90.63	38.28
97.78	57.33	91.80	36.05
97.35	51.05	93.36	37.85
97.65	51.65	92.69	34.78

Days in Crystallizer	*Boiled*	*Cooling Coils.*
10	To Grain	Without.
6	To Grain	With.
9½	—	Without.
5	—	With.

A very peculiar condition was noted in two crystallizers. When boiling blank good and sufficient grain is formed in from 12 to 15 hours but in this instance only a few scattered grains had appeared in 36 hours. As both these crystallizers happened to be equipped with cooling coils, the author turned on the full force of water and, much to his surprise, complete and satisfactory crystallization became evident after 12 hours more. The massecuites were of 95.4 and 95.9 Brix, and 51.4 and 55.0 purity ; they were dried in six to seven days, dried well, and yielded molasses of 35.5 and 36.4 purity. The usual method is to turn the water on the coils 24 hours after the strikes are dropped and to keep it on until one day before drying. The massecuites are then diluted to make them ready for drying. The cycle at the centrifugals is from 30 to 40 mins. and the re-melt averages from 70 to 75° purity.—(*International Sugar Jr.*, Vol. XXXII, No. 383.)

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Soil Science.

The Use of Asphalts and Bitumens on Estates.

The problem of the most suitable substance or mixture for application in connection with tree surgery is of considerable importance. Tars of various origin and variable composition with and without the addition of fungicides have been used generally on wounds caused by wind break or by pruning, for treatment of various stem and branch diseases, and the cutting of the stock in budding operations.

The chief disadvantage of plain tar and of the mixtures usually employed is their effect on the bark and cortex due to penetration. Another disadvantageous factor is that these mixtures when dry are liable to flake off, thus allowing water to enter the wound surface which precipitates the growth of wood destroying organisms.

Experiments described in the *Quarterly Journal of the Rubber Research Institute of Malaya* (Vol. II, No. 3, p. 114), in which mixtures of asphalt or bitumen with kerosene or with various fungicides have been tried, indicate that a very satisfactory and economical product can be made which on account of its elastic properties does not flake off when dry. The mixtures have been applied with satisfactory results in estate practice.

The following mixture has been used with satisfactory results on estates for treating the wounds after branch pruning.

Asphalt (grade DX) ..	50 lb.
Kerosene Oil	4 gallons.

One estate manager found the following very suitable for treating Pink Disease :—

Asphalt (grade DX) ..	40 lb.
Solar oil	4 gallons.
Brunolinum	40 ounces.

For the treatment of budded stocks after cutting back, the following mixture is recommended :—

Asphalt (grade DX) ..	20 lb.
Kerosene oil	1 gallon.

Only a smear of this mixture applied with the thumb is necessary for covering and sealing the cut ends of the stocks.

* * *

Liming and Soil Potash.

The addition of lime to a soil tends to reduce the amount of potash available to plants growing in that soil. Plants growing on a limed soil generally contain a smaller proportion of potash than plants of the same species growing on a similar, unlimed soil. The effect is usually attributed to the solvent power of the calcium bicarbonate in the soil solution on the potash minerals in the soil and to interchange between calcium ions and adsorbed potassium ions. Increased leaching of potash results with ultimate depletion of the store of potash in the soil. The deficiency is reflected in the mineral content of plants growing on the soil. This theory is supported by evidence from laboratory experiments which show that, if a soil is suspended in a solution of a calcium salt, interchange between calcium ions of the solution and potassium ions of the soil does occur. Leaching experiments, however, have failed to support the theory. Leachings from a limed soil generally contain less potash than the leachings from a similar unlimed soil. This contrary evidence has been explained by assuming that the potash liberated by the lime from the upper layers of the soil is re-adsorbed during the passage of the leachings through the sub-soil. To avoid the possibility of the re-adsorption of potash, extensive lysimeter experiments have been conducted using a thin layer of soil only. It was found that after passing through only one layer of soil, the leachings from a limed soil still contained less potash than those from an unlimed soil. The results show conclusively that the addition of lime to a soil does not tend to deplete the total amount of potash in the soil, but tends to lower the amount of potash present in the soil solution and therefore the amount of potash readily available to the plant. "Light" and "heavy" forms of both magnesium and calcium oxides and carbonates behave similarly in depressing the amount of potash in the soil solution. The effect of these liming materials apparently is to charge the soil solution with calcium or magnesium ions which prevent hydrolysis of the potash containing minerals in the soil.—(*Journ. Agri. Sci.*, p. 499, Vol. XX.)

* * *

Synthetic Fat.

A recent patent by Prof. T. P. Hilditch of Liverpool University, covers a method for the production at will of fats of specified properties. A mixture of saturated and unsaturated fatty acids in definite proportions is esterified by heating with a deficiency of glycerin. Suitable mixtures of acids are prepared by saponifying a vegetable fat or fats mixed in a proportion calculated to produce the required acid mixture. If necessary, a proportion of free fatty acid may be added to adjust the mixture finally. Thus, a mixture containing palmitic and oleic and linoleic acids in specified proportions, yields on esterification with glycerin a synthetic lard. A fat resembling tallow may be produced by esterifying a mixture of palmitic, stearic and oleic acids. If cacao butter be saponified and the fatty acids so produced esterified with glycerin, a product resembling mutton tallow is obtained. The process may result in vegetable oils and fats having at present little or no value, being used in the manufacture of fatty materials such as margarine and lard.—(*Ind. Chem.* p. 420, 1930.)

REVIEWS.

Agricultural Implements and Machinery.

By A. J. Spencer and J. B. Passmore, *H.M.S.O.* London, pp. 96, Price 2*s*.

Many of our students will find themselves faced with the necessity of adapting or improvising agricultural machinery of one kind or another to deal with new crops, or to changing conditions. It is likely for instance that the utilisation of oxen for field or road work, in a district where this has not hitherto been customary, will put a very different value on the straw of the local grain crop—a change which may bring in its train the need for modifying the processes of harvesting and threshing. We recommend therefore, as part of a District Officer's equipment, the very stimulating and well illustrated catalogue of the Agricultural Implements and Machinery in the Science Museum, Kensington, for this collection shows, by models or actual specimens, either of early patterns of modern types, or of simple appliances such as are found today in the Tropics, the steps by which modern agricultural machinery has been developed. In the process, many ingenious dodges will be noted, that may prove useful in the circumstances mentioned. To take a single instance; many of us have felt the need of a winnowing machine to make ourselves independent of the vagaries of the wind, but have been at a loss to construct a sufficiently rapid moving spindle without using gears, which are out of the question, or belts, which in the varying degrees of heat and moisture, are never satisfactory. An illustration (Plate IX) supplies the answer: a handle fastened with a swivel to the periphery of a fly wheel and turned by a man facing it. Other illustrations show early types of ploughs, including wooden patterns which are reminiscent of many that our readers will see, in action to-day. An excellent two shillings worth.

R. C. W.

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The South American Handbook, 1931.

By Howell Davies. Published by *Trade & Travel Publications, Ltd.*, 14, Leadenhall Street, London.

This excellent handbook which has been scrupulously revised and brought up to date should provide a very useful guide for the business man, traveller and general reader to all countries southwards from Mexico to Terra del Fuego. Each country is dealt with separately, details being given about its main towns, its physical features, constitution and Government. In each case also a comprehensive survey follows of the country's agricultural and mineral resources, of its foreign trade, public debt, coinage and measures, postal charges, transport, &c. The names of the country's diplomatic representatives in Great Britain and of Great Britain's in each particular country, are also given. Special sections of the book are devoted to the products of South America and to its steamships and air services; the latter giving all the companies operating in South and Central America and Mexico and detailing the routes flown. Another feature of the publication is a "book section" which contains a list of references to literature relevant to the countries which the handbook deals with. The handbook is well illustrated with maps and sketch maps.

G. G.

* * *

Heroes of Health.

By G. A. Gollock. *Messrs. Longmans, Green & Co., Ltd.*, pp. 177.

This small book written apparently for the promotion of hero worship and some enlightenment on health matters for the young generation in Africa, has the distinction of a foreword by Sir Andrew Balfour. It discusses a number of classical personalities of historical medicine grouped with others who are displayed in this rôle for the first time. The manual should prove particularly useful in elementary schools.

E. A. S.

BOOKS RECEIVED.

We have to acknowledge receipt of the following books:—

Plants of the Gold Coast, by F. R. Irving. pp. 522, 69 illustrations. *Messrs. Humphrey Milford, Oxford University Press,* Warwick Square, London, E.C. 4. Price 5*s*.

The South American Handbook, 1931. Edited by Howell Davies. pp. 742, with one map. *The Trade & Travel Publications, Ltd.* 14, Leadenhall Street, London, E.C.3.

Heroes of Health, by G. A. Gollock, pp. 178, illustrations and 2 maps. *Messrs. Longmans, Green & Co. Ltd.* 39, Paternoster Row, London E.C. 4. Price 3*s*. 6*d*.

We have to acknowledge with thanks the following books which have been presented to the Library:—

The Flora of Trinidad & Tobago, Vol. I. Part 2, by R. O. Williams and E. E. Cheesman. *The Government Printer,* Port-of-Spain, Trinidad, B.W.I., presented by the Authors.

The Flora of Trinidad & Tobago, Vol. I. Part 3, by R. O. Williams. *The Government Printer,* Port-of-Spain, Trinidad B.W.I., presented by the Author.

The African Republic of Liberia and the Belgian Congo. Based on observations made and material collected during the Harvard African Expedition, 1926-27. Vols. 1 & 2. Edited by R. P. Strong, Ph.B., M.D., S.D. *The Harvard University Press,* Cambridge. Mass., U.S.A., presented by the Editor.

International Directory of Pedigree Stock Breeders. Edited by R. de Toll, *Vernon Press Ltd.*, 23, Fleet Street, London, E.C.4. presented by G. D. Lister.

All the missing numbers of *A critical revision of the Genus Eucalyptus* (to complete our volumes for binding), by J. H. Maiden. The Government of the State of New South Wales, presented by the Director of the Botanic Gardens, Sydney, New South Wales.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—Prices on the Home Market have ranged as follows (c.i.f. per cwt.) :—

	Foreign.
	s. d.
4th December	6 0
11th December	6 6
18th December	6 1½
27th December	5 9
2nd January	5 6
9th January	6 3
Preferential remained at	9 4½

According to *Messrs. C. Czarnikow Ltd.*, events in connection with the Conference in Brussels which was held in the middle of December monopolised the attention of sugar markets, the trend of feeling in the Trade being entirely governed by the various reports of progress received from time to time. An agreement was reached between the Cuban and Javan delegates in Amsterdam to restrict their output during the next five years, and their proposals placed before the European beet producing countries which were also asked to limit their exports over a period of five years. Although Czecho-Slovakia, Poland, Hungary and Belgium, agreed to restrict their exports within certain limits, Germany was left with an exportable quota which they were unable to accept, and the Conference was suspended after a final protocol had been signed by the remaining delegates in the hope that negotiations with the latter country might be resumed at an early date.

* * *

COCOA.—The cocoa market continues lifeless but conditions are likely to change at any moment. Interest still centres round the Gold Coast farmers hold-up of supplies, and as this crop is now nearing a close, the situation is at a critical stage. The United States Government report 10 per cent. decrease in sales of confectionery for 11 months ended November, 1930, whereas the National Confectioners Association put the decrease at 7.6 per cent. Considering the appreciably lower level of prices for all raw materials the actual tonnage sold can only have decreased little or nothing.—(*By courtesy of the Cocoa Planters' Association, Trinidad.*)

* * *

RUBBER :—Quotations for Plantation Sheet have ranged as follows : 3rd December, $4\frac{1}{16}d.$; 10th December, $4\frac{3}{4}d.$; 17th December, $4\frac{5}{16}d.$, 27th December, $4\frac{3}{8}d.$; 31st December, $4\frac{1}{2}d.$; 7th January, $4\frac{5}{16}d.$

The market has shown a firmer tone. There was particularly active trading in the middle of the month which was due to some American and Continental buying. Prices were put up temporarily and brought out selling by producers of spot and nearby shipment, both British and Dutch producers offering fairly large lines of rubber. As, however, the demand was insufficient to absorb all offerings, prices were not maintained.

* * *

COTTON.—The following are the official spot prices in pence per lb. of the Liverpool Cotton Association :—

	American Mid.	*Egyptian F. G. F. Sakel.*	*Sea Island.*		
			Good.	*Extra fine.*	*Prices paid this Week.*
5th Dec.	5·70	8·65	21·00	36·00	20·00-23·00
12th Dec.	5·43	7·95	21·00	36·00	20·00-21·00
19th Dec.	5·32	7·85	—	—	—
24th Dec.	5·31	7·85	—	—	—
2nd Jan.	5·33	—	—	—	—
9th Jan. .... (local)	5·40	—	—	—	—

American has been very quiet, spot sales being on a restricted scale while present low prices have failed to stimulate demand and inquiry. A feature in the middle of the month of December was the fall in Sakellaridis values which followed upon the demoralised state of the Alexandria market. This was due to international financial stringency following on general distrust of cotton prices as the result of American and Egyptian Government stringency.

* * *

COFFEE.—Latest prices per cwt. include : Santos 55*s.*; Kenya, 100*s.*; fine Kenya up to 138*s.* 6*d.*; Costa Rica, 136*s.* The market for Jamaica is generally dull, low sorts being difficult to sell.

* * *

TEA.—Latest averages per lb. are : Ceylon, 18.95*d.*; India, 14.51*d.*; Darjeeling, 18.13*d.*; Sumatra, 18.87*d.*; Java, 18.10*d.* and Assam, 14.98*d.* Business in 1930 will clearly prove to have been good, averages comparing favourably with 1929. —(*Times Trade and Engineering Supplement*, 20th December.)

* * *

BANANAS.—Jamaicas are in quiet demand and unchanged to wholesalers at £21 per ton delivered (London), and £20 10*s.* delivered nearest railway station ; the price to retailers is $10\frac{1}{2}d.$ per dozen. Brazilians, which have been in strong demand during the past week are £2 lower at £18 delivered nearest railway station.—(*West India Committee Circular*, 25th December.)